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ABSTRACT

A project was conducted to develop a series of interactive microcomputer-controlled videotape training programs in chemical analysis of water quality for the fisheries technician program at Peninsula College (Washington). Improved color video equipment was obtained during the year for development of the training films. Interactive instruction and testing for each training film was developed using a random-access videotape recorder controlled by an Apple IIe microcomputer. Software developed by BCD Associates was purchased for computer program development. Software updates received from BCD late in the year improved the quality of the interaction and program development. Through these activities, eight video training films in chemical analysis of water quality were prepared, and instruction and testing were developed for these training films using a microcomputer and random-access videotape recorder. The expertise gained in this project will be used to develop more interactive video instruction to encompass all chemical tests performed in the fisheries program. (A description of each of the eight videotapes is included in the report.) (KC)

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FINAL REPORT

PROJECT NUMBER 84-ASO(150)NB

DEVELOPMENT OF CHEMICAL ANALYSIS TRAINING PROGRAMS FOR FISHERIES TECHNICIANS UTILIZING AN INTERACTIVE MICROCOMPUTER VIDEOTAPE SYSTEM

Curriculum Development Project

Conducted Under

Public Law 94-482

The project reported herein was performed pursuant to a grant from the Research Coordinating Unit of the Washington State Commission for Vocational Education. Contractors undertaking such projects under the Commission for Vocational Education sponsorship are encouraged to express freely their professional judgement in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Commission for Vocational Education position or policy.

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SUMMARY OF THE REPORT

(a) Major objectives of the project

Our objective was to develop a series of interactive microcomputer controlled videotape training programs in chemical analysis of water quality for the Fisheries Technician program at Peninsula College

Subobjective Number 1: To develop training films in chemical analysis.

Subobjective Number 2: To develop computer interactive instruction and testing interspersed throughout each training film.

(b) Summary of Activities

Improved color video equipment was obtained during the year for development of the training films. Interactive instruction and testing for each training film was developed using a random access videotape recorder controlled by an Apple IIe microcomputer. Software developed by BCD Associates was purchased for the computer program development. Software updates received from BCD late in the year improved the quality of the interaction and program development.

(c) Summary of Results; Accomplishments

Eight video training films in chemical analysis of water quality were prepared for the fisheries technician program. Instruction and testing were developed for these training films using a microcomputer and random access videotape recorder.

(d) Major Conclusions and Recommendations

Computer interactive training films in chemical analysis of water quality have been developed. These programs will be incorporated into the Fisheries Technician Program at Peninsula College during 1985. The expertise gained in this project will be used to develop more interactive video instruction to encompass all chemical tests performed in the Fisheries program.

It is assumed that student interaction with this system before commencing the experiments will result in better results and a more efficient experimental procedure.

Development of this type of training aid is difficult and time consuming. However, we feel the benefits will outweigh these difficulties. During the coming year we will be refining and evaluating the programs and seeking new techniques to make future interactive videotape production more efficient.

(A) Statement of the Problem.

The Peninsula College Fisheries Technology program has developed a two-quarter applied chemistry course relating to water quality and fish productivity for fisheries technicians. This training is useful for hatchery management, aquaculture, and environmental assessment and gives the student a broad background for a variety of employment possibilities in occupations related to fisheries.

Time does not permit nor do the students have sufficient expertise to do extensive field work or handle hazardous chemicals until the fundamentals have been assimilated. The development of videotape programs explaining correct sampling methods and laboratory techniques will enhance student understanding and help ensure water testing procedures. Being able to randomly access a videotape containing multiple testing procedures will result in rapid selection of instructional material for preview prior to performing the experiment. Previewing experiments has significantly facilitated the time of performance and increased the precision of results in other laboratories (8). Make-up assignments can be accomplished much more conveniently and effectively when students miss regularly scheduled exercises due to unforeseen circumstances.

The literature has very little information about interactive videotape instruction. Low cost technology has been available in this area only in the last few years and new applications are currently in the project stage (1-5). We have not found any reference to this method of learning for fisheries technicians. Videotapes have been quite successful in chemical education for both laboratory and concept instruction but were developed prior to the availability of low cost computer interaction (6, 7). Film loops of some chemical laboratory techniques have been on the market for a number of years. These were analyzed prior to our program development. The new technology of video disc computer interaction in education has been appearing in the recent literature. Although the rapid access of information and quality of visuals is ideal, the cost is prohibitive at this time (9).

(B) Objective and sub-objectives of the project

Our objective was to develop a series of interactive microcomputer-controlled videotape training programs in

chemical analysis of water quality for the fisheries technician program at Peninsula College.

Subobjective Number 1: To develop a minimum of ten training films.

Subobjective Number 2: To develop computer interactive instruction and testing interspersed throughout each training film.

(C) Procedures followed

With the assistance of the media department, scripts were written both for the video production and for the computer interaction. With the acquisition of a good video camera, the training films were developed, modified, and edited. The microcomputer instruction using an Apple IIe and a Panasonic random access video tape recorder was developed. Further modifications were required in the video films for accurate control with the software available. An update in the software near the end of the year greatly facilitated program production.

(D) Results and Accomplishments

Eight interactive video training programs on laboratory procedures and the chemical analysis of water quality were prepared for the fisheries technician program. Instruction and testing were developed for these training films using an Apple IIe microcomputer and a random access video tape recorder.

When a student selects a testing procedure the computer automatically finds the portion of the tape to be used and begins it. Each program is interspersed with questions about the main points being covered. A student must answer each question correctly for the next sequence to occur. If the question is answered incorrectly the videotape automatically recycles and repeats the key portion, the reasks the question. The students score is reported at the end.

The following interactive videotape programs have been developed for the technical fisheries chemistry classes:

1. SAFETY AND THE LABORATORY
   This training tape shows the location of the safety equipment used in the chemistry lab and the proper use of safety glasses, fire extinguisher, ventilation systems, shower, eyewash, and first aid supplies.

2. FUNDAMENTAL TECHNIQUES
This tape describes the fundamental techniques common to the general chemistry laboratory including identification and care of equipment, mixing, transferring, filtering, heating, measuring, and glass working.

3. THE CENT-O-GRAM BALANCE
A metal cylinder and a fixed weight of powdered sample are each weighed separately to demonstrate the care, use, and limitations of the CENT-O-GRAM Balance.

4. THE pH METER
Features of the Altex pH meter are explained with emphasis on the fragility and care of the electrodes. Standardization of the instrument using a buffer solution is demonstrated and the pH of an unknown is determined.

5. TITRATION
The titration technique is demonstrated using two burets to determine the concentration of HCl using a known concentration of NaOH with phenolphthalein as the color indicator. Cleaning, proper filling, volume reading and addition methods are described for the buret.

6. DISSOLVED OXYGEN
The Winkler method of determining dissolved oxygen using both the HACH field kit and the laboratory technique is illustrated. The method of water collection and processing prior to titration is explained. Preparation and standardization of sodium thiosulfate and HACH titrant is demonstrated. The titration is performed using starch indicator with a standard buret and also with the HACH dropper method used in the HACH field kit.

7. ALKALINITY
The technique of measuring alkalinity of water using both the HACH field method and the laboratory technique is explained using both titration and pH meter procedures. The titration is performed using a standard buret and a HACH digital titrator with phenolphthalein and bromcresol-green/methyl-red indicators. The need for slow titration is shown using samples at two different temperatures. The pH meter technique with magnetic stirrer is described using the pH readings in combination with color indicators.

8. DISSOLVED AND SUSPENDED SOLIDS
The method used for determining total solids, dissolved solids, and suspended solids is described using evaporating dishes and Gooch crucibles. In this procedure the cleaning, drying with oven and desiccator, heating to constant weight, seating of glass fiber filter papers, sample handling and transfer, and vacuum filtration are demonstrated.

These programs will be available to other educational institutions if so requested. The equipment and software needed are as follows:

1. Model 450 Video Tape Control Interface and "The Instructor" software produced by BCD Associates.

2. A Video Cassette Recorder equivalent with random access capability such as a Panasonic NV-8200.

3. An Apple II or IIe, printer, and monitor. A color monitor for video presentation.

(E) Evaluation

The training programs have been previewed by Will Wirt, Fisheries instructor and Marine Lab director, and Floyd Young, Dean of Instruction. Their impressions were favorable. Early in 1985, the Fisheries Advisory Board will be presented this new technique of instruction. Both first- and second-year Fisheries Technician students will be using these programs in their classes and further evaluation will be forthcoming.

(F) Conclusions and Recommendations

The computer interactive training films in chemical analysis of water quality have been developed. These programs will be incorporated into the Fisheries Technician Program at Peninsula College during 1985.

We are assuming that the comprehension and retention of the procedures and methodology used in the fisheries chemistry classes will be improved and that many common errors and errant results will be eliminated. Students will be required to review the interactive videotapes before proceeding with the experiments. They must correctly answer each question before they can complete the tape. A student will not have to assume he understands via written or spoken instructions what the correct experimental procedure is, but will have seen the procedure and answered questions to cement his understanding before beginning.

The fisheries chemistry classes are given in the first year of the two-year program. Second-year students commonly perform extensive water analysis on their field projects. Review of the videotape programs by these students should result in better sampling procedures and thus more accurate results.

The expertise gained in this project will be used to upgrade this type of interactive video instruction to involve more subject areas in the coming year. We plan to prepare a more extensive project proposal in the near future.

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